

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

**In re Application of:** Delphine Legrand

**Application No.:** 10/069,741

**Filed:** February 26, 2002

**Title:** Detection and Correction of Phase Jumps  
in a Phase Sequence

**Examiner:** Freshteh N. Aghdam

**TC/Art Unit:** 2611

**Confirmation No.:** 5244

**Attny Docket No.:** FR 000067

Mail Stop **Appeal Brief -- Patents**

Commissioner For Patents

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**APPEAL BRIEF**

**Real Party in Interest:**

The real party in interest in this application is KONINKLIJKE PHILIPS ELECTRONICS N.V., the assignee of the inventor's interests in this invention.

**Related Appeals and Interferences:**

There are no other appeals and/or interferences related to this application.

**Status of Claims:**

Claims 1 and 3-10 stand finally rejected by the Examiner. Claim 2 has been cancelled.

The appealed claims are set forth in the attached Appendix.

**Status of Amendments:**

No amendments have been filed subsequent to the final rejection. The Appendix contains the appealed claims.

**Summary of Claimed Subject Matter:**

The claimed invention relates to "communication system[s] comprising at least a transmitter and a receiver intended to receive symbols coming from a [Phase Shift Keying] PSK modulation, and comprising estimation means for estimating a frequency error relating to a symbol based on a sequence of symbol phases. The invention also relates to a receiver intended to be used in such a communication system." (See application as published (US 2002/0168032 A1) at paragraph [0001]).

Prior art estimation means make use of an estimation algorithm of a frequency error, relating to a received symbol, based on a phase sequence, typically referred to as a Tretter algorithm, or least squares method. (See application as published at paragraph [0004]).

In the prior art, "[w]hen the sequence of phases, which are used for applying the Tretter algorithm, includes one or various phase jumps, the frequency estimate obtained is inaccurate. (See application as published at paragraphs [0006]-[0009]).

The claimed invention notably provides a solution to this problem.

To achieve this end, claim 1 recites:

1. A communication system comprising at least a transmitter and a receiver intended to receive symbols coming from a phase-shift keying modulation, and comprising estimation means for estimating a frequency error relating to a symbol based on a sequence of symbol phases (see application as published, figure 1, transmitter 1, receiver 2, paragraphs [0023]--[0025]),

characterized in that said receiver comprises calculation means for calculating a phase sequence, called an initial sequence, based on decisions made on symbols (see application as published, figure 2, means 53, paragraphs [0029]), and means for detecting and correcting phase jumps in this initial sequence, to supply a phase sequence, called final sequence, to said frequency error estimation means (see application as published, figure 2, means 54, paragraph [0031]);

wherein said means for detecting and correcting phase jumps comprise:

- modifying means for modifying said initial sequence so as to produce a plurality of modified sequence, which each compensate for a phase jump configuration (see application as published, figure 3, means 100, paragraph [0038]),

- calculation means for calculating straight line equations which determine the initial sequence and the modified sequences (see application as published, figure 3, means 110, paragraph [0039]), and

- calculation means for calculating for the initial sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal (see application as published, calculation means 120, figure 3, paragraph [0040]).

Claim 6, while differing in scope from claim 1, includes features similar to that of amended claim 1. For example, amended claim 6 recites a "method of estimating a frequency error relating to a received symbol coming from a phase-shift keying modulation, based on a sequence of symbol phases," including "modifying said initial sequence so as to produce a plurality of modified sequence, which each compensate for a phase jump configuration, calculating straight line equations which determine the initial sequence and the modified sequences, and calculating for the initial sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal."

Claim 6 recites:

6. A method of estimating a frequency error relating to a received symbol coming from a phase-shift keying modulation, based on a sequence of symbol phases (see application as published, figure 1, transmitter 1, receiver 2, paragraphs [0023]--[0025]),

characterized in that the method comprises

a calculation step of calculating a phase sequence, called initial sequence, based on decisions made on symbols (see application as published, figure 2, means 53, paragraphs [0029]), and a step of detecting and correcting phase jumps in this initial sequence, to produce a phase sequence, called final sequence, used for the estimation of a frequency error (see application as published, figure 2, means 54, paragraph [0031]);

wherein said step of detecting and correcting phase jumps comprises:

modifying said initial sequence so as to produce a plurality of modified sequence, which each compensate for a phase jump configuration (see application as published, figure 3, means 100, paragraph [0038]),

calculating straight line equations which determine the initial sequence and the modified sequences (see application as published, figure 3, means 110, paragraph [0039]), and

calculating for the initial sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal (see application as published, calculation means 120, figure 3, paragraph [0040]).

Claim 7, while differing in scope from claim 1, recites several of the features described above with respect to claim 1. For example, claim 7 recites "a method of detecting and correcting phase jumps in an initial sequence of symbol phases coming from a phase-shift keying modulation." The method comprises "calculating for the initial sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal."

Claim 7 recites:

7. A method of detecting and correcting phase jumps in an initial sequence of symbol phases coming from a phase-shift keying modulation (see application as published, figure 1, transmitter 1, receiver 2, paragraphs [0023]--[0025]), characterized in that it comprises:

modifying said initial sequence so as to produce a plurality of modified sequences which each compensate for a phase jump configuration (see application as published, figure 3, means 100, paragraph [0038]),

calculating straight line equations which determine the initial sequence and the modified sequences (see application as published, figure 2, means 53, paragraphs [0029]), and

calculating for the initial sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal (see application as published, calculation means 120, figure 3, paragraph [0040]).

Thus, the claimed invention provides systems and methods directed to the detection and correction of phase jumps in a phase sequence for receipt by a receiver.

#### **Grounds of Rejection To Be Reviewed On Appeal**

The grounds of rejection to be reviewed are:

1) Whether Claims 1 and 3-10 are unpatentable under 35 U.S.C. 103(a) as an obvious combination of *Feedforward Frequency Estimation for PSK a Tutorial Review*, IEEE Vol. 9, No. 2 March-April 1998; pg. 103-116 (Morelli) and U.S. Patent No. 5,553,014 (De León);

Applicants maintain that this issue should be decided in favor of patentability because neither of the cited references teach or suggest all of the claim limitations of the present claims.

#### **Argument**

There is one group of claims presenting consideration for review: Claims 1 and 3-10.

**I. The Combination of Morelli and De León Does Not Make Obvious the Inventions of Claims 1 and 3-10**

As set forth in MPEP §2143, a *prima facie* case of obviousness requires that "prior art reference (or references when combined) must teach or suggest all the claim limitations." *See, e.g., In re Royka*, 180 USPQ 580 (CCPA 1974).

All of the claim limitations of claim 1 are not taught or suggested by Morelli or De León, either taken alone or in combination, at least because claim 1 recites a communication system that comprises:

a transmitter and a receiver intended to receive symbols coming from a phase-shift keying modulation ... and

estimation means for estimating a frequency error relating to a symbol based on a sequence of symbol phases, characterized in that **said receiver comprises calculation means for calculating a phase sequence, called an initial sequence, based on decisions made on symbols, and means for detecting and correcting phase jumps in this initial sequence, to supply a phase sequence, called final sequence, to said frequency error estimation means.**

(emphasis added).

The means for detecting and correcting phase jumps comprise:

**modifying means for modifying said initial sequence so as to produce a plurality of modified sequence, which each compensate for a phase jump configuration, calculation means for calculating straight line equations which determine the initial sequence and the modified sequences, and**

**calculation means for calculating for the initial sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal.**

(emphasis added).

As conceded in the final Office Action, Morelli does not teach or suggest "modifying means for modifying said initial sequence so as to produce a plurality of modified sequence, which each compensate for a phase jump configuration, calculation means for calculating straight line equations which determine the initial sequence and the modified sequences," and "calculation means for calculating for the initial sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal."

For these deficiencies, the Examiner cites De León.

Applicant submits that De León describes an adaptive filter system including a coefficient calculator, but does not cure the deficiencies of Morelli.

De León is directed to an acoustic signal processing system for canceling out echoes between, for example, loudspeakers and microphones. (See De León at, for example, Abstract, col. 1, lns. 36-47, and FIG. 1). De León, does not teach or suggest, for example, the claimed "transmitter and a receiver intended to receive symbols coming from a phase-shift keying modulation," and "estimation means for estimating a frequency error relating to a symbol based on a sequence of symbol phases"

De León does describe the use of least mean square (LMS) algorithms, but De León does not teach or suggest, either alone, or in combination with Morelli, "modifying means for modifying said initial sequence so as to produce a plurality of modified sequence, **which each compensate for a phase jump configuration,**" nor



"calculation means for calculating for the initial sequence and the modified sequences a **mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation**, said final sequence being formed by the sequence whose mean difference is minimal."

Accordingly, applicant submits that neither Morelli nor De León, either taken alone, or in combination, teach, describe or suggest the invention recited by claim 1 of the present application, and thus, claim 1 is patentable over any Morelli-De León combination.

Claim 6, while differing in scope from claim 1, includes features similar to that of amended claim 1. For example, amended claim 6 recites a "method of estimating a frequency error relating to a received symbol coming from a phase-shift keying modulation, based on a sequence of symbol phases," including "modifying said initial sequence so as to produce a plurality of modified sequence, which each compensate for a phase jump configuration, calculating straight line equations which determine the initial sequence and the modified sequences, and calculating for the initial sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal."

Claim 7, while differing in scope from claim 1, recites several of the features described above with respect to claim 1. For example, claim 7 recites "a method of detecting and correcting phase jumps in an initial sequence of symbol phases coming from a phase-shift keying modulation." The method comprises "calculating for the initial

sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal."

Accordingly, claims 6 and 7 are deemed patentable over any Morelli-De León combination for at least the same reasons discussed above with respect to the patentability of amended claim 1.

Each of claims 3-5, and 8-10 ultimately depend from one of claims 1, 6 and 7 and are deemed to be patentable, for at least the reasons described above with respect to the patentability of claims 1, 6 and 7.

In view of the foregoing, it is respectfully submitted that Claims 1 and 3-10 are patentable over Morelli and De León, either taken alone, or in combination.

In view of the foregoing, the Final Rejection of the claims should be reversed.

Respectfully submitted,

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**Claims Appendix:**

1. (previously presented) A communication system comprising at least a transmitter and a receiver intended to receive symbols coming from a phase-shift keying modulation, and comprising estimation means for estimating a frequency error relating to a symbol based on a sequence of symbol phases, characterized in that said receiver comprises calculation means for calculating a phase sequence, called an initial sequence, based on decisions made on symbols, and means for detecting and correcting phase jumps in this initial sequence, to supply a phase sequence, called final sequence, to said frequency error estimation means; wherein said means for detecting and correcting phase jumps comprise:

- modifying means for modifying said initial sequence so as to produce a plurality of modified sequence, which each compensate for a phase jump configuration,
- calculation means for calculating straight line equations which determine the initial sequence and the modified sequences, and
- calculation means for calculating for the initial sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal.

2. (cancelled).

3. (previously presented) A communication system as claimed in claim 1, characterized in that said initial sequence is modified phase-group by phase-group.

4. (previously presented) A receiver intended to be used in a communication system as claimed in claim 1.

5. (previously presented) A receiver as claimed in claim 4, characterized in that said initial sequence is modified phase-group by phase-group.

6. (previously presented) A method of estimating a frequency error relating to a received symbol coming from a phase-shift keying modulation, based on a sequence of symbol phases, characterized in that the method comprises a calculation step of calculating a phase sequence, called initial sequence, based on decisions made on symbols, and a step of detecting and correcting phase jumps in this initial sequence, to produce a phase sequence, called final sequence, used for the estimation of a frequency error;

wherein said step of detecting and correcting phase jumps comprises:

modifying said initial sequence so as to produce a plurality of modified sequence, which each compensate for a phase jump configuration,

calculating straight line equations which determine the initial sequence and the modified sequences, and

calculating for the initial sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal.

7. (previously presented) A method of detecting and correcting phase jumps in an initial sequence of symbol phases coming from a phase-shift keying modulation, characterized in that it comprises:

modifying said initial sequence so as to produce a plurality of modified sequences which each compensate for a phase jump configuration,

calculating straight line equations which determine the initial sequence and the modified sequences, and

calculating for the initial sequence and the modified sequences a mean difference between the initial or modified phases and the phases produced by the corresponding straight line equation, said final sequence being formed by the sequence whose mean difference is minimal.

8. (previously presented) A method of detecting and correcting phase jumps as claimed in claim 7, characterized in that said initial sequence is modified phase-group by phase-group.

9. (previously presented) A program comprising instructions for implementing the steps of a method of detecting and correcting phase jumps as claimed in claim 7 when said program is executed by a processor.

10. (previously presented) A program comprising instructions for implementing the steps of a method of estimating a frequency error relating to a received symbol, as claimed in claim 6, when said program is executed by a processor.

**Evidence Appendix:**

There is no evidence which had been submitted under 37 C.F.R. §§ 1.130, 1.131 or 1.132 or any other evidence entered by the Examiner and relied upon by Appellant in this Appeal.

**Related Proceedings Appendix:**

Because there are no related proceedings identified herein, there are no decisions rendered by a court or the Board in any proceedings identified pursuant to paragraph c(1)(ii) of 37 C.F.R. § 41.37.